EQECAT
AN ABS GROUP COMPANY

Euroflood™

EQECAT's Europe Flood Model

Euroflood is a fully probabilistic risk model that quantifies risk from flooding in Germany and Austria. There have been several updates to the model since the release of the initial riverine Germany flood model in 2005. The riverine component was enhanced and off-plain flood modeling was added for all of Germany in 2006. Coverage was broadened to the Danube basin in Austria in 2006. In 2009, Euroflood was incorporated into WORLDCATenterprise™, with significant improvements in analysis speed and refinements to exposure geocoding and loss calculation. Modeled risk types and coverages have been added.

- **Peril Definition/Geographic Coverage:**
  - Riverine flood: In Germany, river-based flooding is modeled for the Rhine, Elbe, Oder, Weser, Ems, and Danube, and their major tributaries. In Austria, river-based flood is modeled for the Danube basin, including exposed areas of its major tributaries: the Salzach, Inn, Ager, Krems, and Enns rivers.
  - Off-plain flood: Flood risk outside river-based flood plains is modeled for the rest of Germany. This hazard represents flooding caused by the accumulation of precipitation. (Flash flooding where the hazard is flowing water, coastal storm surge, mudslides, and drainage system backup are not modeled.)
- **Hazard Definition/Derivation - Riverine:** Water depth is the hazard that drives damage. Riverine and off-plain flooding are both primarily derived from a pan-European precipitation module. Euroflood tackles the complexity of flood events with a modular approach comprising the following elements:
  - Precipitation events: Probabilistic precipitation events are based on a sampling of eight different parameters of heavy precipitation systems, such as intensity and area, and detailed historical loss data over a 43-year period. Source data includes re-analysis from the European Centre for Mid-Range Weather Forecasts (ERA – 40) and daily precipitation data from national meteorological stations. Over 13 million probabilistic heavy precipitation events stratified to 32,000 hydrological events provide a complete stochastic set that captures correlation between river basins.
  - Precipitation to discharge: For each stochastic event, the total and effective run-off per catchment area is calculated using a unit hydrograph approach. Topographic and antecedent precipitation, azimuth, and the potential effect of snow melt are taken into account.
  - Discharge to water height: This module calculates water discharge rates at points in the river system according to a water routing calculation that considers the effects of both convolution and dispersion.
  - Water height to flood defences: Embedded flood defence information is used to model defence breaching probabilistically. Data sources include local authority and digital terrain model data.
  - Defence failure to flood propagation: Water is propagated laterally to hazard cells. The module calculates flood volumes and water heights using a detailed digital terrain model (DTM).
- **Hazard Definition/Derivation – Off-plain:** For Germany, off-plain flood hazard is derived from the same precipitation event set. It diverges in approach from the use of a GIS-raster flood definition module to produce water heights outside river floodplains. Euroflood combines a hydrodynamic approach with digital terrain model source data.
- **Probabilistic Event Set:** The stochastic event set is based on 32,000 synthetic heavy-precipitation systems and corresponding flood events to create a pan-European stochastic set that allows for accurate correlation between river basins.
- **Exposure Definition:** In the absence of detailed exposure data, Euroflood uses an embedded built environment module to select the most likely structure type and elevation for building stock that exists in the specified area. This enables aggregate exposure data to be disaggregated to appropriate hazard cells for analysis.

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- **Vulnerability Derivation:** Vulnerability functions were derived from first principles using ABS Consulting engineering data and third-party studies, and were refined with claims data. An engineering-based approach with validation against claims data provides greater model stability than relying on claims data alone.
- **Model Validation:** Each model component was reviewed against scientific data and published studies. The model was also favorably reviewed by independent academic experts. Tests included:
  - Precipitation event set and water heights sets were validated against published historical meteorological and hydrological data. For both riverine and non-riverine flooding, water extent and water depth outputs from the model were validated against published flood maps.
  - The built environment module was validated in two ways: first, through visual inspection of sample postcodes to verify that the module corresponds well with the real distribution of building types, structure type, building height, etc.; second, it was compared to postcode-level insured portfolios and census data to verify accurate distribution of the insured value per structure type and other attributes.
  - Vulnerability functions were validated first against detailed post-flood studies that assessed typical damage to properties (percentage building/contents damaged against hazard intensity), and second against actual claims paid, taking into account deductibles, insurance and market conditions, and demand surge.
  - Loss results were validated against insurance company portfolio losses for various events.

Inland flooding in Europe is typically a result of prolonged or intense precipitation and is responsible for both frequent and high severity losses. In recent history, the Elbe flood event in 2002 stands out as a significant European natural catastrophe. In Germany alone, it resulted in economic damage of around €9 billion and insured losses of approximately €1.8 billion. In Austria, economic damage from flooding of several rivers, including the Danube basin, came to approximately €3 billion, with insured losses at €400 million. Flooding in 2005 produced additional losses for both countries. In Austria, economic damage and insured losses were estimated at more than €500 million and €150 million respectively.*

* Figures from the Austrian Insurance Association and AXCO

MODEL SPECIFICATIONS

- **Lines of Business:** Residential, Commercial, Industrial, Municipal, and Agricultural
- **Structure Types and Occupancies:** All appropriate structure and occupancy types per line of business are modeled. Risk classifications are aligned with European nomenclature and other EQECAT European hazard models.
- **Insurance Coverages:** Building, Contents, and Business Interruption are modeled.
- **Exposure Import and Disaggregation:** Data can be imported at lat/long level, postcode, place name, CRESTA Zone, and country level. Number of stories, the existence of a cellar, and occupancy can be defined for detailed data. Aggregated data at postcode level is disaggregated and geocoded using the embedded built environment module.
- **Hazard Analysis Resolution:** Based on 50m x 50m hazard cells per underlying digital terrain model data.
- **Financial Modeling:** All major insurance policy structures and reinsurance treaty types are modeled, based on WORLDCATenterprise platform functionality.
- **Model Output:** Provides standard probabilistic risk metrics, including full loss exceedance curve, annualized losses, event-by-event output and tail value at risk for damage and insured loss, including standard deviation. Risk reporting resolution is supported to postcode and lat/long level.

FOR MORE INFORMATION, PLEASE CONTACT:

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